

QUALITY IMPROVEMENT OF ACETES BALL IN CURRY PROCESSED AT 121.2⁰ C

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ABSTRACT

Quality of acetes balls in curry was improved by studying effects of setting, level of moisture, filling media, levels of transglutaminase enzyme and types of starch. To find out a suitable method the effects on biochemical viz. pH and moisture, physical viz. gel strength and expressible water percentage and organoleptic evaluation were studied. In the present experiment, effect of filling media showed an improvement in texture and gel strength. Among the effect of filling media, plain acetes balls without curry (PABWOC) showed superior texture followed by plain acetes balls with curry (PABWC), spice mixture acetes balls without curry (SABWOC) and spice mixture acetes balls with curry (SABWC).

KEYWORDS: *Acetes Balls, Setting, Transglutaminase Enzyme, Types of Starch & Level of Moisture and Filling Media*

Received: Mar 23 2017; **Accepted:** Apr 10, 2017; **Published:** Apr 17, 2017; **Paper Id.:** IJASRJUN20171

INTRODUCTION

In India, most of the shrimp of genus *Acetes*, popularly known as Jawala is consumed by local people regularly either in fresh or dried form in the preparation of day-to-day food dish. Dried acetes is available year round in the market; however, functional properties of protein in fresh acetes are lost after it is dried. Fresh meat of acetes can be used for the preparation of acetes mince, thereby retaining their desired functional properties. In recent years there is a great demand for seafood and seafood based products, especially value-added products in the Ready-to-eat 'convenience' form. Present trends in the marketing reflect a rapidly growing demand for such processed foods that are more convenient to handle, store and prepare.

Emulsion type fish paste products are traditional products of Japan and these products possess high gel strength, white colour and bland taste characteristics which are preferred by Japanese consumers. In the similar lines different emulsion type of products have been developed from fresh acetes mince suitable to Indian palate such as acetes sausage (Nagothkar, 2013), acetes sandwich (Sonavane, 2014) and acetes chikuwa, acetes steamed wada, acetes ball in curry and other products (Joshi, 2014). These products are generally consumed immediately after preparation and can also be stored for short term at 0 to 2 °C or for long term storage, these are frozen and held at -20 °C. For storage at room temperature these products have to be processed at 121.2 °C in retort pouch as reported by Shaikh *et al.* (2017) who concluded that processing of acetes balls in curry at 121.2 °C for 42 min was necessary to achieve better sensory quality and this trend was reflected by changes in the physical and biochemical parameters. However the texture and folding test grades of acetes balls in curry subjected to thermal processing were lower than the steamed acetes balls (later mixed with curry). So far no work has been carried out on the improvement of texture of acetes balls subjected to thermal processing. Therefore, in the present study to improve

the texture of acetes ball in curry subjected to thermal processing, various methods were adopted.

MATERIALS AND METHODS

Frozen surimi prepared from pink perch (*Nemipterus japonicus*), procured from a commercial factory was thawed before use. Fresh acetes procured from Mumbai landing center was sorted, cleaned, frozen and brought to Ratnagiri and stored in the cold storage of Naik ice and cold storage, Ltd. Whenever required frozen whole acetes was thawed, passed through meat separator and subjected to shell and moisture separation and was used immediately for the preparation of acetes ball in curry, according to the recipe of Joshi *et al.*, (2014).

Curry paste was prepared according to the recipe (Table 1) of Joshi *et al.*, (2014). Oil was heated in pan and finely cut onion was added and fried till brown colour and then made into paste. In a separate pan oil was heated and finely-cut tomato was added and fried, and then made into paste. Later in an another pan, oil was heated and garlic, ginger, coriander seed powder, spice mixture and salt were added and fried. To this pan onion paste red chilly powder and turmeric were added and the mixture was cooked along with the tomato paste. The above curry paste was mixed with oil and heated for 2 minutes, and later mixed with water in 1: 0.5 ratio and boiled for 5 minutes.

Spice mixture acetes ball was prepared according to the recipe (Table 2) of Joshi *et al.*, (2014). Acetes meat and surimi were added in silent cutter and ground well for 2 min, then salt was added and ground for 2 minutes. Later starch, red chilly powder, coriander seed powder, spice mixture, coriander leaves paste and ginger-garlic paste were added and mixed them well by continued grinding. Acetes ball paste weighing 10 gm was molded into balls.

The above procedure was repeated for the preparation of plain acetes ball (Table 3) except for addition of spice mixture and paste of Joshi *et al.*, (2014). Acetes meat and surimi were ground well in silent cutter for 2 min, then salt was added and grinding was continued for 2 minutes. Later starch was added and grinding was continued. Acetes ball paste weighing 10 gm was molded into balls.

Acetes balls were kept for overnight at 0 °C, brought to room temperature, steamed at 100 °C (0 psi) for 30 minutes, packed in retort pouch along with curry (acetes ball 100g and curry 150g), sealed, washed, stacked in retort and subjected to thermal processing at a retort temperature of 121.1 °C for 42 minutes. Steam was then shut off and simultaneously air and water were pumped inside the retort to maintain the internal pressure of 25 psi and cooling was continued inside the retort till the temperature at cold spot of the product inside the pouch reached 30 °C. Later the pouches were wiped dry and stored until further use. Acetes ball in curry product was subjected to biochemical i.e. pH and moisture (AOAC, 2005), physical i.e. gel strength and expressible water percentage (Suzuki, 1981) and organoleptic evaluation (ISI, 1975). Control, samples were prepared without setting and subjected to same procedure as above.

In the second experiment, five sets of acetes ball paste were prepared by mixing the different types of starch namely corn starch, modified starch, wheat starch, tapioca starch while the control was without starch.

In the third experiment, five sets of acetes ball paste were prepared by mixing the various ingredients with different concentrations of transglutaminase enzyme (TG – AK having a composition of 0.6% TGase, 60% trisodium phosphate and 39.4 % soyabean protein obtained from Ajinomoto Co., Ltd) in the acetes ball paste at 0.1%, 0.2%, 0.3%, 0.4% while the control was without enzyme.

In the fourth experiment on effect of different levels-of-moisture, three sets of acetes balls were prepared by

mixing various types of ingredients viz. wet ingredients, dry ingredients and without ingredients along with surimi, starch and salt.

In the fifth experiment on effect of filling media, two sets of acetes ball with spice mixture and two sets of plain acetes ball, were prepared and packed along with and without curry i.e. spice mixture acetes balls with curry (SABWC), spice mixture acetes ball without curry (SABWOC), plain acetes ball with curry (PABWC) and plain acetes ball without curry (PABWOC) were prepared following the above procedure (with curry) and the products without curry, were subjected to thermal processing at a retort temperature of 121.2 ⁰C for 83 minutes (Shaikh, 2017). The products so prepared were subjected to physical, chemical and organoleptic analysis as mentioned before.

Table 1: Recipe of Curry Paste for Liquid Curry

Sr. No.	Ingredients	Quantity In G
1	Onion paste	136
2	Tomato paste	53
3	Garlic paste	5
4	Chilly powder	2.34
5	Turmeric powder	0.5
6	Coriander seed powder	0.72
7	Spice mixture	0.62
8	Green chili paste	2.9
9	Coriander leaves paste	1.44
10	Ginger paste	1.2
11	Salt	3.3
12	Total curry paste	212.02
13	Remaining part water	90
14	Total curry	302

Table 2: Recipe of Acetes Balls

Sr. No.	Ingredients	Quantity In G
1	Acetes mince	75
2	Surimi	25
3	Starch	15
4	Salt	2
5	Garlic paste *	4
6	Red chilli powder	2
7	Coriander seed tpowder	2
8	Spice mixture	4
9	Coriander leaves paste*	1
10	Ginger paste *	0.5
11	Total	129.5

Note: * added raw

Table 3: Recipe of Plain Acetes Balls

Sr. No.	Acetes Ball Paste	Weight in G
1	Acetes mince	75
2	Surimi	25
3	Starch	15
4	Salt	2

RESULTS AND DISCUSSIONS

Of the five methods attempted, four methods, i.e., effect of setting, effect of different types of starch, different levels of transglutaminase enzyme and level of moisture did not improve the qualities of acetes ball in curry after thermal processing, as compared to steamed ones. Similar observations have been made by Runglerdkriangkrai *et al.* (2006) for canned fish balls in brine and George *et al.* (2015) for fish ball in curry product.

In the case of effect of filling media, it was found that the textural scores (Figure 1) of plain acetes balls without curry (PABWOC) were higher ($p < 0.05$) as compared to plain acetes balls with curry (PABWC), spice mixture acetes balls without curry (SABWOC) and spice mixture acetes balls with curry (SABWC). Similarly folding test grade of both control and PABWOC was found to be higher (A) accompanied by lower expressible water percentage (4.1 %) as compared to other three products. However, the colour and taste scores of PABWOC were lower as compared to PABWC, SABWOC and SABWC.

Similar observations have been made by George *et al.* (2015) i.e. plain fish balls without curry had higher textural scores along with higher folding test grades and lower expressible water percentage as compared to others. However, Runglerdkriangkrai *et al.* (2006) reported a decrease in textural scores of fish balls processed at 116 °C for 30 minutes as compared to steamed (unsterilized) samples.

Saralaya *et al.* (1978) reported that the textural score of canned pink perch fish sausage (in natural casing) had lower values, which indicates fair quality. The difference in this and the present study may be due to the difference in preliminary treatment. In the former study, leakage of components could have occurred from the fish sausage paste stuffed in natural casing which is porous in nature, to the water while pasteurizing in hot water i.e. at 80 °C for 20 minutes. Also difference in the composition of the raw material, ingredient and ingredient ratio might be contributing to the variation in the textural scores.

In the present study, the acetes balls were steamed at 100 °C for 30 minutes and had high gel strength i.e. high folding test grade. This higher initial gel strength formed in the acetes balls might have resulted in retention of higher gel strength during thermal processing (at 121.2 °C). For this reason traditional Japanese style fish paste products such as kamaboko etc. are steamed at 100 °C for different duration depending on size (Suzuki, 1981).

However, in the present study the textural scores of acetes balls subjected to thermal processing were slightly lower than those of steamed (100 °C, 0 psi) acetes balls (Table 2 and Figure 3). This may be attributed to the loss of total SH plus SS groups which occur during oxidation to cysteic acid or splitting to hydrogen sulphide (Nakai and Li-Chan, 1988; Yamazawa *et al.*, 1979). H₂S formation originated from the free reacting SH groups of actomyosin starts at about 80 °C and increases exponentially with rising temperature (Hamm and Hofmann, 1965).

The above factor responsible for gel strength reduction due to thermal processing may not be operational in PABWOC and SABWOC in which low moisture level exists due to the entrapment within the gel matrix already formed prior to packing and processing.

It was found in the present study that the pH (Figure 2) of plain acetes balls without curry (PABWOC and SABWOC) was higher than other products (PABWC and SABWC). The differences in pH may be due to the absence of curry as a filling media in PABWOC increase in the relative concentration of acetes meat and surimi, thereby resulting an

increase in the moisture content.

The pH of plain acetes balls in the PABWC and SABWC products after thermal processing with liquid curry was found to be decreased which may be due to the absorption of organic acids from the curry. Similarly George *et al.* (2015) also observed that the pH of plain fish ball, subjected to thermal processing without curry was higher.

The moisture content (Figure 3) of SABWC and PABWC showed higher values after thermal processing (67.55 and 71.2 % respectively) compared to steamed control (64.35 and 69.98 % respectively). This may be due to the entry of moisture from the curry. However, the moisture content of SABWOC and PABWOC did not show any changes.

The moisture content of plain acetes balls was found to be higher as compared to that of curry ingredient. This could be due to the relative increase of acetes meat and surimi as a consequence of nonaddition of curry as a filling media and thereby increasing the moisture content in plain acetes balls without curry as compared to plain acetes balls with curry, spice mixture acetes ball without curry and spice mixture acetes ball with curry.

Similar trends on the effects of filling media in the moisture content of plain fish ball and ingredient incorporated fish ball have been observed by George *et al.* (2015).

The expressible water percentage (Figure 4) of SABWC, SABWOC and PABWC showed higher levels of 9.7, 9.6 and 9.5 % after thermal processing from an initial value of 4.09, 4 and 3.9 % in control steamed acetes balls. In PABWOC, it did not show any change after thermal processing (4.1) compared to control steamed (4.11) acetes balls. Among the four products PABWOC held higher folding test grades and lower expressible water percentage indicating improvement in gel strength and texture of acetes balls after thermal processing. Similar trends on the effects of filling media in the expressible water percentage of plain fish ball and ingredient incorporated fish ball have been observed by George *et al.* (2015).

The folding test grade of SABWC, SABWOC and PABWC were lower (B, B and B) after thermal processing from an initial higher folding test grades (A) in control steamed acetes balls. While the folding test grades of PABWOC (A) did not show any changes after thermal processing from control steamed (A) acetes balls.

The present investigation indicates that the folding test grade of PABWOC was higher accompanied by lower expressible water percentage as compared to PABWC, SABWOC and SABWC after thermal processing. This may be due to the absorption of moisture and acid from the curry during thermal processing and thereby reducing the gel strength. Similar observations were made by George *et al.* (2015) in case of fish ball in curry.

Among the different methods tried, the effect of filling media were found to improve the quality and the preference given for the product can be summarized as plain acetes balls without curry (PABWOC) > plain acetes balls with curry (PABWC) > spice mixture acetes balls without curry (SABWOC) > spice mixture acetes balls with curry (SABWC).

CONCLUSIONS

Based on this above study, it can be concluded that the plain acetes balls without curry (PABWOC) and plain acetes balls with curry (PABWC) are superior in texture, folding test grade along with lower expressible water percentage after thermal processing at 121.2 ⁰C. However, soft texture products like SABWC would fulfill the criteria of suitability to Indian palate.

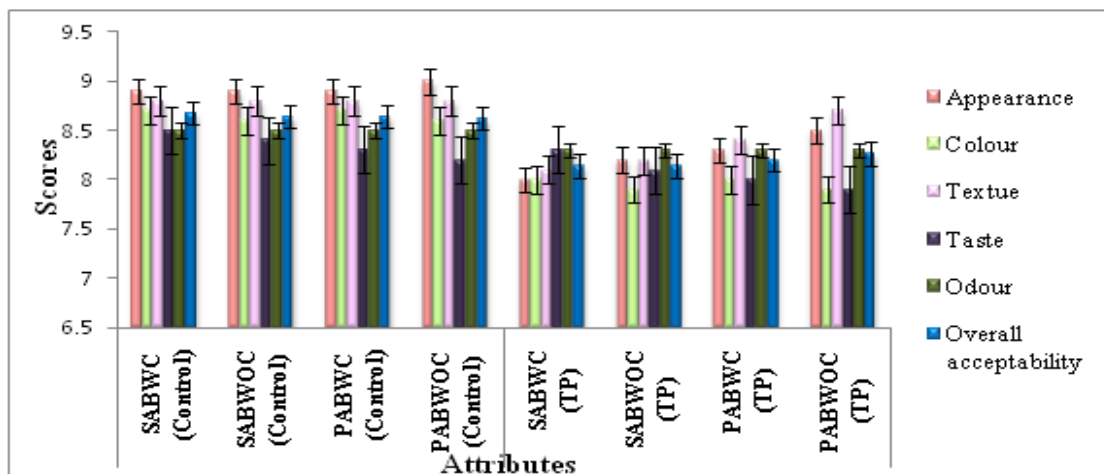


Figure 1: Effect of Filling Media on the Mean Organoleptic Score of Acetes Balls in Curry Processed at 121.2 °C

Note: SABWC – Spice mixture acetes ball with curry, SABWOC – Spice mixture acetes ball without curry
PABWC-Plain acetes ball with curry, PABWOC - Plain acetes ball without curry

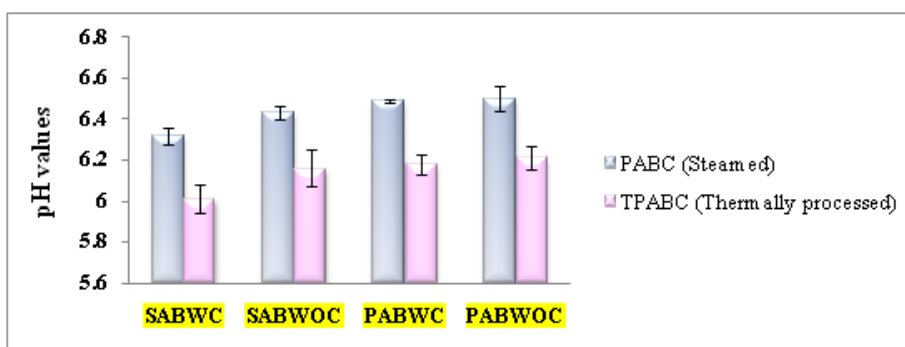


Figure 2: Effect of Different Types of Filling Media on the pH of Acetes Balls in Curry Processed at 121.2 °C

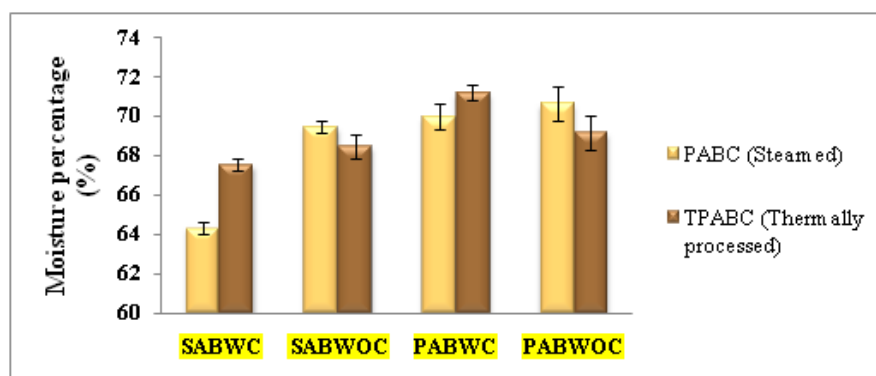


Figure 3: Effect of Different Types of Filling Media on the Moisture Content of Acetes Balls in Curry Processed at 121.2 °C

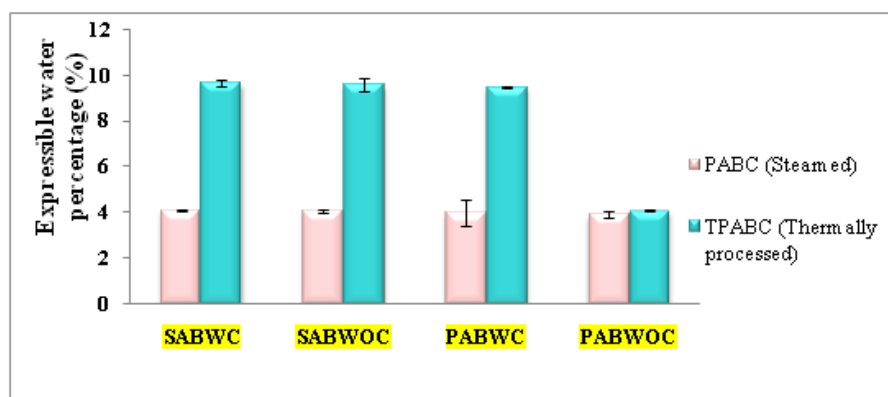


Figure 4: Effect of Different Types of Filling Media on the Expressible Water Percentage of Acetes Balls in Curry Processed At 121.2⁰ C

Note: PABC – Pasteurized acetes ball in curry TPABC – Thermally processed acetes ball in curry

ACKNOWLEDGEMENT

The authors are thankful to Associate Dean, College of Fisheries, Ratnagiri and Vice-Chancellor of Dr. B. S. Kokan Krishi Vidyapeeth, Dapoli, (India) for their encouragement and providing necessary facilities for the present work.

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